REMARKS

This is in response to the Office Action mailed February 14, 2001, in the above-referenced application. Claims 1 - 62 and new Claims 63 - 66 are pending in the application.

Claims 17, 28, 30, 48 and 59 are amended to clarify the structure of the thermally splittable multicomponent fibers of the present invention and associated fiber bundles produced therefrom. More particularly, Claims 17, 28 and 30 are amended to emphasize an inherent advantage of the thermally separable multicomponent fibers of the present invention, namely, that the weight ratio of the non-elastomeric component does not change as a result of splitting by thermal treatment.

Claims 48 and 59 are also amended to emphasize that the component geometries are beneficially chosen to provide free dissociation of the components during thermal treatment. Support for this amendment can be found in the application as filed, for example at Page 8, lines 5 - 9.

Claims 1 - 16, 34 - 47, and 60 - 62, directed to non-elected aspects of the present invention, have been cancelled.

Claims 63 - 66 are added to complete the record for consideration by the Examiner and to highlight various advantageous embodiments of the invention.

The rejections of record are addressed below. Reexamination and reconsideration of this application, withdrawal of the rejection, and formal notification of the allowability of all claims as now presented are earnestly solicited in light of the remarks which follow.

Election of Claims

Applicants hereby confirm election of Group II (Claims 17 - 33 and 48 – 59). Accordingly, Claims 1 - 16, 34 - 47, and 60 - 62, directed to non-elected aspects of the present invention, have been cancelled. Applicants expressly reserve the right to file divisional applications or take such other appropriate measures deemed necessary to protect the inventions in the remaining claims.

Rejections Under 35 U.S.C. § 112

Claims 17 -33 and 48 - 59 stand rejected under 35 USC § 112, as being indefinite for failing to particularly point out and distinctly claim the invention.

The Office Action objects to the recitation of "said microfilaments" in Claims 17, 23, 24, 28, and 30. Claims 17, 28 and 30 have been amended to more clearly recite that the elastomeric and non-elastomeric microfilaments originate from a common multicomponent fiber. Applicants respectfully submit that this recitation overcomes the Examiner's objection with respect to Claims 17, 28 and 30, as well as their dependent claims, namely Claims 18 - 27, 29, and 31 - 33. This amendment is supported in the Application as filed, for example at Page 6, lines 5- 9. Accordingly, Applicants respectfully request withdrawal of this rejection.

Claim 24 stands rejected as indefinite based on its recitation of "comprises about 8 to 48 microfilaments." Claim 24 has been amended to recite that a total of about 8 to about 48 microfilaments are present in the fiber bundle, as suggested by the Examiner. This amendment is supported in the Application as filed, for example at Page 14, lines 23 - 24. Accordingly, Applicants respectfully request withdrawal of this rejection.

Claims 26, 27 and 29 are objected to based on their recitation of "yarn" and "fiber bundle." A fiber bundle is the collection of elastomeric and non-elastomeric microfilaments resulting from separation of the multicomponent fiber into its constituent parts. See the Application as filed, Page 4, lines 13 - 15. Yarn is a term of art that generally refers to a continuous strand of textile fibers, filaments, or material in a form suitable for fabric formation. Yarns occur in several forms, including a number of fibers twisted together, as known in the art. See *Manmade Fiber and Textile Dictionary*, pages 160 - 161, attached at Tab 1. Accordingly, one skilled in the art would readily understand that a yarn may be formed from one or more fiber bundles that have been processed so as to make them suitable for fabric formation. Suitable processes by which to form fiber bundles into such yarns would further be readily apparent to one skilled in the art. Accordingly, Applicants respectfully submit that one skilled in the art would understand the meaning of these terms and request withdrawal of this rejection.

Claim 32 stands rejected based on its recitation of a "fabric." Claim 32 has been amended to correct an apparent typographical error in its dependency. Accordingly, Applicants respectfully request withdrawal of this rejection.

Claim 56 is objected to based on its recitation of "pie/wedge fibers" and "segmented round fibers." The terms "pie/wedge" and "segmented round" fibers are terms that one skilled in the art readily recognizes as referring to particular component geometries within multicomponent fibers. As illustrated in Figure 1A of the Application-as-filed "pie/wedge" configurations include alternating contiguous component segments that converge at the center of the multicomponent fiber. In contrast, as illustrated in Figure 1B of the Application-as-filed the components within "segmented round" fibers, although contiguous, do not converge at the center of the multicomponent fiber. Accordingly, Applicants respectfully submit that one skilled in the art would understand the meaning of these terms and request withdrawal of this rejection.

Rejections Under 35 U.S.C. § 102

Claims 17-26, 28-33 and 59 stand rejected under 35 USC § 102(b) as anticipated by U.S. Patent No. 4,663,221 to Makimura et al.

By way of background, multicomponent fibers capable of separation into fine filaments formed of their component parts are known. Multicomponent fibers are also commonly referred to as "composite" fibers. Conventional means by which to separate multicomponent fibers to date include applying physical force to the composite fiber, such as by needlepunching or hydroentangling, or by dissolving a component out of the composite fiber. However, striking the composite fiber during the separation process decreases the bulk of the resulting component filaments. Separation by dissolution gives rise to a number of material yield and environmental issues.

Applicants have found that multicomponent fibers capable of thermal separation can be provided by selecting components that exhibit differences in both their elastic behavior and their solubility parameters. More specifically, the claimed invention is generally directed to multicomponent fibers that include an elastomeric component and a non-elastomeric component.

The elastomeric component is selected to have a solubility parameter (δ) sufficiently different from the non-elastomeric component to allow the elastomeric component and the non-elastomeric component to separate upon thermal treatment, such as by contact with a heated gaseous medium, thereby forming a fiber bundle made up of non-elastomeric and elastomeric microfilaments.

Although not wishing to be bound by theory or explanation of the invention, including elastomeric and non-elastomeric components having suitable solubility parameters within a single composite fiber may allow the multicomponent fiber to develop sufficient internal stresses at the component interfaces to promote splitting in response to thermal treatment. Internal stresses may be imparted by means such as drawing, or stretching, the composite fibers until the non-elastomeric component is plastically deformed.

Following release of the drawing tension, the elastomeric component, which is merely elastically deformed, attempts to recover its original shape. However, the plastically deformed non-elastomeric component remains permanently stretched, and the adhesion between the two components does not allow the elastomeric component to recover.

This retardation in the elastic recovery of the elastic component gives rise to internal stresses between the two components. These internal stresses are subsequently released upon thermal treatment which weakens the adhesion between the two components. More particularly, it is believed that during thermal treatment the elastic recovery forces within the elastomeric component overcome the weakened adhesive forces between the non-elastic and elastic components, thereby separating the components and allowing the elastomeric microfilaments to relax back to their initial length.

Surprisingly, fiber bundles are produced that contain elastomeric microfilaments and bulked plastically deformed non-elastomeric microfilaments. More particularly, following thermal treatment the resulting non-elastomeric microfilaments are forced by the elastomeric contraction of the elastomeric component to bulk and from a fuzz substantially surrounding the elastomeric microfilaments. The contracting force of the elastomer shortens the length (end-to-end straight line distance) occupied by the bundle. Because the drawn plastically deformed non-

elastomeric filaments are longer than the contracted, or relaxed, elastomeric filaments, the non-elastomeric components bunch up to span the same end-to-end distance as the contracted elastomeric strands.

One of the benefits of the fibers of the claimed invention is their consistency throughout the separation process. For example, in contrast to fiber bundles produced by conventional dissolution methods, the weight ratio of the non-elastomeric bulked microfilaments within the fiber bundle of the present invention is substantially identical to the weight ratio of the non-elastomeric component within the multicomponent fiber, because no mass has been eliminated during separation. Claims 17, 28 and 30 are amended to clarify this aspect of the invention.

The present invention also gives rise to fiber bundles that cumulatively retain the approximate cross section of the multicomponent fiber while under tension, as, again, no mass is eliminated during separation, as provided in Claim 62. The use of thermal treatment to dissociate the fibers of the present invention also provides fiber bundles which have a denier substantially equal to the multicomponent fiber from which it was formed, as recited in Claim 65. Further, the ability to dissociate fibers thermally allows a wide range of fiber configurations to be employed. For example, fiber bundles in which elastomeric and non-elastomeric microfilaments exhibit comparable deniers may be provided, as recited in Claim 63.

In contrast to the present invention, Makimura is directed to composite fibers that are separated by dissolution. More particularly, Makimura et al. is directed to a composite fiber construction that includes an elastomeric core surrounded by a sea-island component. The island component is a non-elastic fiber forming polymer surrounded by a soluble polymer as the sea component. Alternatively, the elastomeric core is surrounded by a non-elastic fiber forming polymer and soluble polymer occurring radially and alternatively. See the '221 patent, Col. 2, lines 12 - 20. Following fabric formation, solvent dissolves the soluble polymer out of the composite fiber to leave an elastomeric core filament surrounded by smaller denier non-elastic filaments. See the '221 patent, Col. 2, lines 55 - 59 and Col. 5, lines 10 - 31.

The multi-component fibers of the present invention do not include a soluble polymer component to provide separation. Rather, the elastomeric and non-elastomeric components are

selected based upon relative solubility parameters so that the elastic component and the non-elastic components split upon thermal treatment. Consequently, there is no loss of mass in the claimed invention during separation, i.e. there is no loss of dissolvable polymer during separation. Stated differently, the weight ratios of the various components within the present composite fibers remains constant as the multicomponent fiber is separated into its respective elastomeric and non-elastomeric microfilaments.

For example, the weight ratio of the non-elastomeric microfilaments within the fiber bundle is substantially identical to the weight ratio of the non-elastomeric component within the multicomponent fiber prior to splitting, as recited in amended Claims 17, 28 and 30. From a more mechanical perspective, separation by thermal treatment provides fiber bundles formed from elastomeric and non-elastomeric microfilaments whose cross sections while under tension can be recombined to cumulatively define the approximate cross section of the multicomponent fiber from which they were formed, as recited in Claim 63. Further, the retention of mass during separation further provides fiber bundles that exhibit comparable deniers to the multicomponent fiber used to produce them, as recited in Claim 64.

Thus the claimed invention clearly differs structurally from Makimura. In Makimura, the weight ratios of the various components shift upon dissolution due to the loss of the soluble polymer, as does the cross section and denier of the resulting fiber bundle. As noted earlier, the retention of mass during separation is highly beneficial both economically and environmentally. Further, the retention of mass and comparable deniers of the present invention would translate into tighter resulting fabrics in comparison to the fabrics of Makimura, in which the soluble polymer is removed after fabric formation. Further, in contrast to the higher denier elastic filaments of Makimura, the elastomeric and non-elastomeric microfilaments of the present invention can have comparable deniers, as recited in Claim 64. Accordingly, Applicants respectfully submit that Claims 17-26, 28-33, 59, new Claims 63 and 64 are patentable in light of Makimura.

Rejections Under 35 U.S.C. § 102/103

Claims 48-58 stand rejected under 35 USC § 102(b) as anticipated by or, in the alternative, under 35 USC § 103 as obvious over Makimura et al. in view of U.S. Patent No. 5,895,710 to Sasse et al.

As noted above, Makimura et al. is directed to a composite fiber construction that includes an elastomeric core surrounded by a sea-island component in which the island component is a non-elastic fiber forming polymer surrounded by a soluble polymer as the sea component. The fiber geometry selected for a given multicomponent fiber is greatly influenced by the separation technique. For example, sea/island configurations such as those employed by Makimura are common in composite fibers separated by dissolution.

In contrast, the fiber components of the present invention are arranged to allow the components to dissociate without being physically impeded. Accordingly, Makimura does not teach or suggest the multicomponent fibers recited in Claims 48 - 58, in which the elastomeric and non-elastomeric polymer components are arranged in distinct unocclusive cross-sectional segments.

Further, Makimura certainly does not teach or suggest the advantageous bicomponent fibers recited in Claim 65. In fact, Makimura, directed to composite fibers including a minimum of three components, teaches away from bicomponent fibers altogether.

Sasse does not cure the deficiencies in Makimura. Sasse is generally directed to splittable filaments that include at least one hydrophilic or hydrophilically modified component and a hydrophobic component. See the '710 patent, Col. 5, lines 10 - 13 and Col. 7, lines 1 - 5. Insufficiently hydrophilic polymers may be wettably modified by the addition of surfactant. See the '710 patent, Col. 5, line 66 - Col. 6, line 6. Recommended polymer pairings include polyolefin/polyamide, polyolefin/polyester, and polyamide/polyester. See the '710 patent, Col. 7, lines 27 - 44. Sasse separates hydrophilic and hydrophobic components using a hot aqueous split inducing medium. See the '710 patent, Col. 3, lines 8 - 12. The split-inducing medium is applied just prior to or during the filament drawing step. See the '710 patent, Col. 3, lines 12 - 13. The separated filaments may then be further processed, such as formed into nonwoven webs and the

like. See the '710 patent, Col. 2, lines 41 - 43.

Accordingly, Sasse does not teach or suggest the present invention, namely, a multicomponent fiber including at least one elastomeric polymer that is elastically deformed and at least one component comprising a non-elastomeric polymer which is plastically deformed. Rather, Sasse teaches away from the multicomponent fibers of Claim 48 because the fibers are separated into its component filaments prior to deformation.

Sasse also does not teach or suggest using elastic polymers as claimed. Rather, Sasse teaches away from the elastomers of the present invention by incorporating a non-elastic segment, such as polyamide, into a copolymer containing an elastic segment, such as polyurethane, thus decreasing the overall elastic properties of the resulting polymer. See the '710 patent, Col. 5, line 36. Sasse thus especially teaches away from the beneficial aspects of the invention provided in Claim 52, reciting polyurethane as the elastomeric polymer.

There is no motivation to combine Makimura and Sasse. The two references address the same issue, separation of composite fibers, by altogether different means. Makimura is directed to the formation of microfilaments by dissolving out a fugitive component. Sasse is directed to the separation of bicomponent fibers based on differences in the hydrophilic characteristics of the respective components.

In fact Makimura teaches away from the process used in Sasse. In this regard, Makimura separates the composite fibers subsequent to fabric formation to restrict the elastic characteristics of the elastomer and thus avoid "the problems which are often encountered ... during the steps of weaving or knitting, mix spinning, and carding, etc., as a result of marked differences in elongation and elastic recovery characteristics between the elastomer and nonelastic polymer. See the '221 patent, Col. 2, line 55 - Col. 3, line 3. In contrast, Sasse clearly divides the composite fibers prior to fabric formation.

However, even if one were to combine the teachings of Makimura and Sasse (which Applicants submit there is no motivation to do), the claimed invention would not result. Makimura is generally directed to sheath/core composite fibers in which the sheath further defines a sea-island configuration. Sasse is generally directed to composite fibers formed from a

combination of hydrophilic and hydrophobic components that are separated prior to drawing. Accordingly, even if one were to combine Makimura and Sasse, the claimed invention, directed to a multicomponent fiber containing distinct unocclusive cross-sectional segments that include at least one elastomeric component which is elastically deformed and at least one non-elastomeric component which is plastically deformed, would not result. Accordingly, Applicants respectfully submit that Claims 48-58 are patentable in light of Makimura, alone or in combination with Sasse.

Rejections Under 35 U.S.C. § 103

Claim 27 stands rejected under 35 USC § 103 as unpatentable over Makimura et al. Claim 27 recites yarns in which the non-elastomeric and elastomeric microfilaments are different colors and the yarn has a first color in its unstretched condition and a second color in its stretched condition. As noted in the Office Action, Makimura et al. do not teach or suggest dyeing. Consequently, Makimura certainly does not teach or suggest dyeing the non-elastomeric and elastomeric microfilaments different colors. Accordingly, Applicants respectfully submit that the Office Action relied upon an improper hindsight analysis, and request withdrawal of this rejection.

Claim 56 is rejected under 35 USC § 103 as unpatentable over Makimura et al. and further in view of U.S. Patent No. 5,783,503 to Gillespie et al. However, Gillespie does not cure the deficiencies in the primary reference.

Gillespie is generally directed to spunbonded fabrics formed from composite fibers in which the surface energies of the components are selected to promote fiber separation. See the '503 patent, Col. 2, lines 25 - 28 and lines 43 - 48. As with Sasse, Gillespie separates the composite filaments prior to fabric formation. For example, Gillespie notes that splitting can be accomplished during free fall from the spinneret. See the '503 patent, Col. 2, lines 62 - 65.

There would have been no motivation to combine Makimura and Gillespie. The two references similarly address the same issue, separation of composite fibers, by altogether different means. Makimura is directed to the formation of microfilaments by dissolving out a

fugitive component. Gillespie is directed to the separation of multicomponent fibers based on differences in the surface energies of the respective components. Thus Makimura cautions against the teachings of Gillespie, as well. As noted above, Makimura separates his composite fibers subsequent to fabric formation to avoid problems encountered in forming fabric from filaments exhibiting marked differences in elastic behavior. See the '221 patent, Col. 2, line 55 - Col. 3, line 3. In contrast, as with Sasse, Gillespie divides the composite fibers prior to fabric formation.

Even if one were to combine Makimura and Gillespie (which Applicants submit there is no motivation to do), the claimed invention would not result. Makimura is generally directed to sheath/ core composite fibers in which the sheath defines a sea-island configuration. Sasse is generally directed to composite fibers having a combination of components with differing surface energies that are separated prior to or during drawing. Accordingly, even if one were to combine Makimura and Gillespie, the invention of Claim 56, reciting a multicomponent fiber containing distinct unocclusive cross-sectional segments that include at least one elastomeric component which is elastically deformed and at least one non-elastomeric component which is plastically deformed, would not result. Accordingly, Applicants respectfully submits that Claim 56 is patentable in light of Makimura, alone or in combination with Gillespie.

CONCLUSION

It is respectfully submitted that Applicants have made a significant and important contribution to the art, which is neither disclosed or suggested in the art. It is believed that all pending claims are now in condition for immediate allowance. It is requested that the Examiner telephone the undersigned should the Examiner have any comments or suggestions in order to expedite examination of this case.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required

therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

Cathy R. Moore

Cathy R. Moore
Registration No. 45,764

Customer No. 00826
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

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Version with Markings to Show Changes Made:

17. (Amended) A fiber bundle comprising a plurality of elastomeric microfilaments and a plurality of plastically deformed non-elastomeric microfilaments which are more bulked than said elastomeric microfilaments, said elastomeric and non-elastomeric microfilaments originating from a common multicomponent fiber having elastomeric and non-elastomeric components, wherein said elastomeric polymer has a solubility parameter (δ) sufficiently different from said non-elastomeric polymer so that said elastomeric component and said non-elastomeric component split upon thermal activation and further wherein the weight ratio of the non-elastomeric microfilaments within the fiber bundle is substantially identical to the weight ratio of the non-elastomeric component within the multicomponent fiber.

24. (Amended) The fiber bundle of Claim 17, wherein said fiber bundle comprises a total of about 8 to about 48 microfilaments.

28. (Amended) A fiber bundle comprising a plurality of elastomeric polyurethane microfilaments and a plurality of plastically deformed non-elastomeric polypropylene microfilaments which are more bulked than said elastomeric microfilaments substantially surrounding said elastomeric polyurethane microfilaments, said elastomeric polyurethane and non-elastomeric polypropylene microfilaments originating from a common multicomponent fiber having elastomeric polyurethane and non-elastomeric polypropylene components which split upon thermal activation, and the weight ratio of the non-elastomeric polypropylene microfilaments within the fiber bundle is substantially identical to the weight ratio of the non-elastomeric polypropylene component within the multicomponent fiber.

30. (Amended) A fabric comprising a plurality of elastomeric microfilaments and a plurality of plastically deformed non-elastomeric microfilaments which are more bulked than said elastomeric microfilaments, said elastomeric and non-elastomeric microfilaments

originating from a common multicomponent fiber having elastomeric and non-elastomeric components, wherein said elastomeric polymer has a solubility parameter (δ) sufficiently different from said non-elastomeric polymer so that said elastomeric component and said non-elastomeric component split upon thermal activation and further wherein the weight ratio of the non-elastomeric microfilaments within the fiber bundle is substantially identical to the weight ratio of the non-elastomeric component within the multicomponent fiber.

32. (Amended) A product comprising the fabric of Claim [29] 30, selected from the group consisting of synthetic suede and filtration media.

48. (Amended) A splittable multicomponent fiber comprising:
at least one component comprising an elastomeric polymer, which is elastically deformed so that said elastomeric component is capable of substantially complete recovery to its original length upon release of drawing tension; and

at least one component comprising a non-elastomeric polymer, which is plastically deformed so that said non-elastomeric component maintains substantially its same length after drawing upon release of drawing tension,
wherein said elastomeric polymer has a solubility parameter (δ) sufficiently different from said non-elastomeric polymer so that said elastomeric component and said non-elastomeric component split upon thermal treatment and said elastomeric and non-elastomeric polymer components are arranged in distinct unocclusive cross-sectional segments.

59. (Amended) A fabric comprising a plurality of splittable multicomponent fibers comprising at least one polymer component comprising a non-elastomeric polymer which is plastically deformed so that said non-elastomeric component maintains substantially its same length after drawing upon release of drawing tension and at least one polymer component comprising an elastomeric polymer which is elastically deformed so that said elastomeric component is capable of substantially complete recovery to its original length upon release of

drawing tension and release of adhesion to the non-elastomeric component;
wherein said elastomeric polymer has a solubility parameter (δ) sufficiently different from said non-elastomeric polymer so that said elastomeric component and said non-elastomeric component split upon thermal activation and said elastomeric and non-elastomeric polymer components are arranged in distinct unocclusive cross-sectional segments.